CLAIMS

What is claimed is:

1.   A time division duplex using code division multiple access user equipment, the user equipment for receiving a plurality of data signals in a time slot, each data signal experiencing a similar channel response, the user equipment comprising:

an antenna for receiving radio frequency signals including the plurality of data signals;

a demodulator for demodulating radio frequency signals to produce a baseband signal;

a channel estimation device for estimating the similar channel response at a multiple of a chip rate of the combined signal; and

a data detector device for constructing a channel response matrix representing a channel of the data signals based on in part the estimated channel response, determining a spread data vector based on in part a fast fourier transform (FFT) decomposition of a circulant version of the channel response matrix, and despreading the spread data vector to recover data from the received combined signal.

2.   The user equipment of claim 1 wherein the multiple of the chip rate is twice the chip rate.

3.   A time division duplex using code division multiple access user equipment, the user equipment receiving a plurality of data signals in a time slot, each data signal experiencing a similar channel response, the user equipment comprising:

an antenna for receiving radio frequency signals including the plurality of data signals;

a demodulator for demodulating radio frequency signals to produce a baseband signal;

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a channel estimation device for estimating the similar channel response; and

a data detector device for constructing a channel correlation matrix representing a channel of the data signals based on in part the estimated channel response, determining a spread data vector based on in part a fast fourier transform (FFT) decomposition of a circulant version of the channel correlation matrix, and despreading the spread data vector to recover data from the received combined signal.

4.   The user equipment of claim 3 wherein the combined signal is sampled at a multiple of a chip rate of the combined signal and the sampled combined signal is input into the channel estimation and data detector device.

5.   The user equipment of claim 4 wherein the multiple of the chip rate is twice the chip rate.

6.   The user equipment of claim 3 wherein the combined signal is sampled at a chip rate of the combined signal and the sampled combined signal is input into the channel estimation and data detection device.

7.   The user equipment of claim 3 wherein the FFT decomposition is performed using a permuted first row of the channel correlation matrix.

8.   The user equipment of claim 3 wherein the FFT decomposition is performed using a defining row of the channel correlation matrix.

9.   A time division duplex using code division multiple access user equipment, the user equipment for receiving a plurality of data signals in a time slot, each data signal experiencing a similar channel response, the user equipment comprising:

means for receiving a combined signal over the shared spectrum in the time slot, the combined signal comprising the plurality of data signals;

means for sampling the combined signal at a multiple of a chip rate of the combined signal;

means for estimating the similar channel response;

means for determining a spread data vector based on in part a fast fourier transform (FFT) decomposition of a circulant version of the channel response matrix; and

means for despreading the spread data vector to recover data from the channel response matrix.

10.   The user equipment of claim 9 wherein the multiple of the chip rate is twice the chip rate.

11.   A time division duplex using code division multiple access user equipment, the user equipment receiving a plurality of data signals in a time slot, each data signal experiencing a similar channel response, the user equipment comprising:

means for receiving a combined signal over the shared spectrum in the time slot, the combined signal comprising the plurality of data signals;

means for estimating the similar channel response;

means for constructing a channel correlation matrix based on in part the estimated channel response;

means for determining a spread data vector based on in part a fast fourier transform (FFT) decomposition of a circulant version of the channel correlation matrix; and

means for despreading the spread data vector to recover data from the received combined signal.

12.   The user equipment of claim 11 wherein the combined signal is sampled at a multiple of a chip rate of the combined signal and the sampled combined signal is input into the estimating and determining means.

13.   The user equipment of claim 12 wherein the multiple of the chip rate is twice the chip rate.

14.   The user equipment of claim 11 wherein the combined signal sampled at a chip rate of the combined signal and the sampled combined signal is input into the estimating and determining means.

15.   The user equipment of claim 11 wherein the FFT decomposition is performed using a permuted first row of the channel correlation matrix.

16.   The user equipment of claim 11 wherein the FFT decomposition is performed using a defining row of the channel correlation matrix.